



## DESCRIPTION

METHOD FOR THE CLARIFICATION OF SLUDGE

## FIELD OF THE INVENTION

The present invention relates to a method for the clarification of a sludge, for example, wash water from a pigshed, a cowshed or a chicken house, or waste wash water from a butchery, or waste water from ~~a feeds processing~~ food-processing factory, and ~~a~~ clarification equipment ~~thereof~~ therefore.

## DESCRIPTION OF THE PRIOR ART

In Japan, from approximately 10 years ago, the pollution of ground water is becoming very serious. Further, the pollution of ~~river is~~ rivers are also becoming ~~worth~~ worse. By a river environment improving campaign of some volunteer ~~party~~ parties, several polluted ~~river is~~ rivers are becoming ~~to be~~ improved, however, the environmental improvement of ~~river~~ the rivers is ~~so~~ limited and ~~is~~ has not ~~progress~~ progressed as ~~we please~~ well as desired.

In particular, the pollution of groundwater is a serious problem at the present time. Nitrogen ~~compound is~~ penetrated compounds penetrate into the ground water and spontaneously ~~decomposed~~ decompose and ~~forms~~ form nitric nitrogen, and we are using the ground water as life water.

When nitric nitrogen invades into the human body, it spontaneously ~~decomposed~~ decomposes and forms nitrous nitrogen, and the formed nitrous nitrogen invades into ~~human's~~ human blood, hinders

the movement of hemoglobin in the blood and causes a problem of lack of oxygen for a human, and further forms a carcinogenic compound. W.H.O. (World Health Organization) ~~regulated~~ regulates a standard value of 10mgNO<sub>3</sub>-N/L. Further, the standard value of Japan is settled to the same value as the W.H.O., however, in Japan, there are ~~fairly numbers~~ a number of regions where the value of the ground water ~~excess~~ exceeds the standard. The main reason ~~of~~ for the pollution of the ground water is considered to be caused by the agricultural environment.

~~Agriculture~~ The agriculture of Japan today is summarized ~~as~~ as a problem of excess ~~of~~ nitrogen. Among the agricultural ~~field~~, a fields, the treatment of ~~excrements~~ the excrement of domestic animals is the biggest problem. Since the improvement of ground water pollution is the fundamental object to keep our daily life, it is the most urgent business for us to develop the ~~most~~ best suited means which can ~~dissolve~~ solve said object.

As the conventional method for the treatment of ~~excrements~~ the excrement of domestic animals, the underground infiltration method, biological treatment and penetration membrane treatment can be mentioned as main methods. The underground infiltration method is the same as the discharge and is a main origin of the ground water pollution. Regarding the biological treatment, ~~funges~~ fungi do not always work through a year. Further, the color of urine does not ~~discolored~~ discolor. Especially, people working in domestic ~~animals~~ animal breeding fields, ~~feeds~~ feed fodder by mixing medicines in it. For the purpose ~~to protect~~ of protecting against infection, water with disinfectant is used as a washing water for a cattle

shed. Since chemicals are ~~mixing~~mixed with ~~exerements~~excrement, biological treatment ~~can not~~cannot be a dissolving method. ~~And,~~  
~~regarding~~Regarding the treating method by a penetration membrane, the treating amount is low and cost for treatment becomes too high, therefore, this method ~~can not~~cannot be used as an actual method. Accordingly, now--a--day, ~~exerements~~the excrement of domestic animals and waste water after cattle shed washing are discharged on the ground.

In a food processing factory, the treatment of waste water has a problem. For example, the treatment of waste fluid with coffee dregs, which is a by-product of a coffee production process or treatment of canned coffee after a relishing period, are not ~~dissolved~~resolved problems. Especially, in canned coffee after a relishing period, sugar, ~~antioxidant~~antioxidants or ~~flavor~~flavors are contained and a method for the treatment of these compounds is not accomplished. Samely, the treatment of canned or ~~bottles~~bottled green tea, red tea or cola are also serious problems. Further, regarding the treatment ~~for~~of waste fluid from a Shochu (Japanese spirits) production process, a method ~~for~~of treatment is quite in the dark. Waste fluid from a Sake production process is similar. Some of them are treated by a digestion tank method, which is popular in the treatment of waste water from a butchery, however, the capacity of the method is full and ~~can not~~cannot entirely satisfy the demands ~~entirely~~.

#### SUMMARY OF THE INVENTION

The present invention ~~is to provide~~provides a method for the clarification of a waste fluid from a cattle shed containing ~~excrements~~the excrement of domestic animals or from a food-  
-processing process, which are the main origins of ~~ground-~~  
~~water~~groundwater pollution, by a physical method without using chemicals or biological treatment and, further, the costs~~cost~~ for equipment and ~~cost for~~ treatment can be reduced.

The essential point of the present invention is a method for the clarification of a sludge comprising, the steps of separating a waste fluid raw solution to ~~solid~~solids and a liquid by a solid-liquid separator and a first filtration apparatus, and then treating the obtained liquid state--treated product by a process containing an ozone treatment and a specific ray treatment.

#### BRIEF ILLUSTRATION OF DRAWINGS

Fig.\_1 and Fig.\_2 are illustrating views of a treatment of ~~excrements~~excrement from a pig shed. Fig. 3 and Fig. 4 are illustrating views of ozone treatment and Fig.\_5 is an illustration view of a ray treating chamber, wherein, (a) is an upright style chamber and (b) is a lateral style chamber.

#### DESCRIPTION OF THE PREFERRED ~~EMBODIMENT~~EMBODIMENT

The present invention will be illustrated more in detail.

In the present invention, the terms ~~of~~ "waste fluid" and "raw solution" indicate a liquid which can be a ~~single~~source of sludge or pollution, specifically said terms indicate waste wash water from a cattle-shed, the urine of domestic animals, waste water from

~~feeds~~food processing or waste water from a butchery. Further, said terms indicate waste canned coffee of an over relishing period, waste fluid from a Shochu production process, waste fluid from a Sake production process or waste fluid from all other beverage production ~~process~~processes. The present invention is a method for the clarification of these waste fluid·raw solution to the admitted environmental standard value level.

In the present invention, a waste fluid·raw solution is separated ~~to solid~~into solids and ~~liquid~~liquids by a solid-liquid separator, and the separated ~~solid is~~solids are used as an organic fertilizer or as a soil conditioner.

The separated liquid is treated by an ozone treatment ~~by~~under the following conditions. That is, ozone is added to a waste fluid·raw solution by  $3.0\text{Nm}^3/\text{H}$  flow rate at a normal temperature. The flow rate of ozone to be added can be changed according to the shape or capacity of a tank. For example, by  $1.2\text{Nm}^3/\text{H}$ ,  $1.5\text{Nm}^3/\text{H}$  -  $8.0\text{Nm}^3/\text{H}$  or by  $0.3\text{Nm}^3/\text{H}$  -  $9.0\text{Nm}^3/\text{H}$ . For the purpose ~~to improve~~of improving the effect of the ozone reaction, the shape of the reaction tank is designed so ~~as that~~ the raw solution ~~to be~~can easily ~~flow~~flow by convection. Further, ozone is added from a lower position of the reaction tank and, ~~and~~ for the purpose ~~to improve~~of improving the reaction effect, an ozone discharging nozzle is processed to have a star--like shape. By processing the discharging nozzle to have a star--like shape, ozone bubbles are ~~granulated~~generated more finely and enter between particles of the solution so as to accelerate the ozone reaction. Although the time necessary for the ozone

treatment changes according to the amount of the solution to be treated, however, it is approximately from 30 to 90 minutes.

Specific ~~ray is~~ rays are irradiated ~~te~~ into a waste fluid·raw solution which is treated by ozone treatment. The wavelength of the specific ray ~~rays~~ differs slightly according to the power of the source, and the irradiation of ultraviolet ~~ray~~ rays of 165nm-225nm wavelength or near-ultraviolet ~~ray~~ rays of 225nm-350nm is carried out. Although the irradiation time differs according to the kind of waste fluid·raw solution, it is approximately ~~is~~ from 60 ~~minute~~ to 90 minutes. By this irradiation, various fungi contained in the stock solution are sterilized and pigments contained in the stock solution ~~are decomposed~~ decompose.

Either ozone treatment or specific ray treatment can be carried out first, or ozone treatment or specific ray treatment can be carried out alternatively and ~~repeatedly~~ repeatedly. As a method for specific ray irradiation treatment, ~~Raw~~ raw urine liquid is sprayed ~~misty~~ or foggy in a mist or fog, or a wet wall method can be used too. Or, a raw urine liquid can be introduced from a lower position of a specific ray treatment tank, which is specially processed, and can be reacted with irradiation by flowing to an upper side by a back eddy method using flowing water of 40L/min. Further, ozone treatment or specific ray treatment can be carried out simultaneously by using a specially processed reaction tank. ~~Aiming~~ In order to remove a ~~decomposed product~~ or extracted product formed by the ozone ~~treatment~~ or specific ray treatment, the liquid after the ozone ~~treatment~~ or specific ray treatment is passed through a filtering

apparatus. As a filter, activated carbon, clay, zeolite or sand can be used.

~~Above mentioned~~ The above-mentioned process is shown by a flow sheet in Table 1<sub>7</sub> and is illustrated more in detail.

Table.1

1. liquid (waste fluid)
- ↓
2. solid-liquid separation
- ↓
3. treatment tank + O3
- ↓
4. specific ray treatment (upright style, lateral style)
- ↓
5. filtering apparatus
- ↓
6. treated water

\_\_\_\_1. Introduce a liquid (waste fluid) which contains solids.

\_\_\_\_2. As the first step, said liquid is separated to a liquid part and ~~solid~~ solids part. As a method ~~for~~ of separation, any kind of ~~a~~ centrifuge, ~~a~~ screen separator or ~~a separation~~ separator by difference ~~of~~ in specific gravity can be used. By a separator, since a complete separation of 100% is impossible, the liquid after separation (waste fluid) is filtrated. As the method for filtration, a filter press, screw press, natural filtration, suction filtration or vacuum filtration can be used. ~~Solid part is~~ The separated solids are used as a soil conditioner.

\_\_\_\_3. ~~Liquid~~ The liquid, after the solids are removed (waste fluid), is transferred to a treatment tank. By passing through a specially processed liquid-ozone gas mixing device, which is equipped ~~to~~ at the lower position of the treatment tank, fine



~~granulation~~mixing of the liquid and ozone is carried out (refer to Fig. 3). ~~Make the~~The liquid ~~form~~is in a suited~~suitable~~ state to ~~be decomposed~~decompose easily by an ozone reaction and by the next process step. During the reaction, the liquid is stirred by a stirrer equipped to the top of the tank. When the rotating speed of the stirrer is fixed to 150-300 r.p.m., a good reaction effect can be accomplished.

4. Liquid~~Liquid~~ (waste fluid) which is treated by ozone treatment is transferred to a specific ray treatment chamber. ~~Upright~~An upright style chamber or lateral style chamber can be mentioned as a specific ray treatment chamber, and an easier type for use can be selected according to the place where the chamber is set (refer to Fig. 5). ~~Spiral shape~~A spiral-shaped liquid guide plate of 50 pitches from entrance to exit is set up to inside of the chamber and the liquid (waste fluid) to be treated is discharged by rotating. A ray source lamp is set up in the inside of the chamber. ~~Numbers~~The number of ~~the~~ ray source ~~lamp~~lamps can be changed according to the quantity of liquid (waste fluid) treated. For example, when the quantity of liquid to be treated is 10t/day, ~~number~~the number of ~~the~~ ray source ~~lamp~~are lamps is 12, and when the quantity of liquid to be treated is 20t/day, ~~number~~the number of ~~the~~ ray source ~~lamp~~are lamps is 21, ~~that~~. That is, it can ~~meet~~range from a small quantity to a large quantity. The liquid is decomposed by the ray having a specific wavelength mentioned above by rotating and becomes harmless and is discharged from an outlet.

5. Liquid~~The liquid~~ (waste fluid) after the ray treatment is ~~filtrated~~filtered. As a method ~~for~~of filtration, a filter press,

screw press, natural filtration or vacuum filtration can be used. As a filter, activated carbon, activated clay, zeolite or ~~diatomaceous~~diatomaceous earth can be used.

6. After all of these ~~processes are over~~steps have been completed, all standards based on "Water Pollution Control Law" are cleared and it becomes possible to discharge the liquid from an outlet. Further, the liquid (waste fluid) after being treated can be used as washing water in a factory.

#### Example

As an Example of the present invention, the treatment of ~~excrement~~excrement from a pigshed shown in Fig.\_1 and Fig.\_2 is illustrated. This example is characterized in that ozone treatment and specific ray treatment are carried out simultaneously (end parts of pipe a, b, c and d of Fig.\_1 are joined with a, b, c and d of Fig.\_2).

##### (1) Raw ~~excrement~~excrement tank

~~Excrement~~Excrement from a pigshed and wash water from a pigshed are gathered together in a raw ~~excrement~~excrement tank (1), which is buried ~~in~~ underground. The gathered raw ~~excrement~~excrement is pumped up and transferred to a solid-liquid separator (2).

##### (2) Solid-liquid separating apparatus

~~Liquid~~The liquid transferred from the underground stock tank is separated ~~to solid~~into a solids part and a liquid part by a solid-liquid separator (2) which rotates ~~by~~at a high speed. The ~~solids~~solids part is discharged from an outlet (2-1) and ~~is~~ recovered

as a soil conditioner whose nitrogen content is small by a ~~separated~~separating process. The liquid part is discharged from an outlet (2-2) and transported to No.\_1 tank (3).

(3) No.\_1 tank

No.\_1 tank is a tank to be used as a stocker in which the liquid part, after solid-liquid separation, is stored.

(4) No.\_1 filtering apparatus

~~Aiming to~~To remove small solids which ~~cannot~~cannot be separated by solid-liquid separating apparatus (2), the liquid is passed through No.\_1 filtering apparatus. The filter used in No.\_1 filtering apparatus (4) is zeolite.

(5) No.\_2 tank

After ~~passed~~passing through No.\_1 filtering apparatus, the liquid part of ~~excrements~~the excrement is recovered in No.\_2 stock tank (5).

(6) First treatment apparatus

~~Recovered~~The recovered liquid part of ~~excrements~~the excrement in No.\_2 stock tank (5) is transported to first treatment apparatus (6). First treatment apparatus (6) carries out ozone treatment and specific ray irradiation treatment simultaneously. ~~This~~The first treatment apparatus (6) ~~is consisting~~consists of two reaction tanks which are formed to have an inclination of 35 degrees from ~~3/1-position~~the lower third of the ~~tank~~tanks to the bottom of ~~tank~~the tanks. ~~Liquid~~The liquid part of ~~increments~~the excrement transported from tank No.\_2 is poured into these 2 tanks and ~~full~~fill the tanks. Specific ray irradiation is carried out simultaneously with ozone ~~blowing~~being blown in. ~~Aiming~~In order to improve the effect, the

liquid part of ~~excrement~~the excrement is stirred. A stirrer is equipped with a propeller or a wire ~~brush~~brush which are processed to have a sawteeth shape at a pointed end of it, and ~~granulate~~pulverize the liquid part of ~~excrement~~the excrement to fine particles. At the bottom of the reaction tank, there is a nozzle to blow in ozone, which is processed to have a star--shape, and ultra--fine bubbles of ozone is blown in from the nozzle and ~~is~~ mixed with ultra--fine particles of the liquid part of ~~excrement~~the excrement. Thus, ultra \_fine bubbles of ozone are mixed with ultra--fine particles of the liquid part of ~~excrement~~the excrement and thus the reaction is accelerated.

The purpose of this process is to clarify the raw ~~excrement~~excrement by 60-70%.

(7) No.\_2 filtering apparatus (this process and after this process are shown in Fig.\_2)

After the first treatment is over, the liquid part of the raw ~~excrement~~excrement is transported to No.\_2 filtering apparatus (7). Impurities which are separated and extracted at the first treatment (for example, nitrogen ~~compound~~compounds, phosphorus ~~compound~~compounds or particles of pigment) are removed. ~~Filter which~~ The filter used in this process is a fine powder of activated carbon. As the other filters which can be used, clay or calcined zeolite can be mentioned.

(8) Second treatment apparatus

~~Liquid~~The liquid part of ~~excrement~~the excrement (7) which ~~have~~has passed through No.\_2 filtering apparatus is transferred to a second treatment apparatus. The shape of the reaction tank

of this apparatus is the same as that of the first treatment apparatus. The purpose of this process is to clarify ~~balance~~ the balance of the 30-40% of raw ~~excrement~~ excrement which is not clarified by the first treatment apparatus. Further, the method for treatment is the same as that of the first treatment. ~~Time~~ That time for treatment of this process is approximately 60 minutes.

~~Treating process~~ The treating processes of the first treatment and the second treatment ~~treatments~~ are the same, however, if the first treatment covers the second treatment, the time for treatment becomes 6 hours longer and the clarification ratio is not so good. By dividing to first ~~treatment~~ and second ~~treatment~~ treatments, the reaction can be carried out surely, the time for treatment can be shortened and the treating capacity can be improved.

(9) No.\_3 filtering apparatus

After the second treatment is over, the liquid part of the excrement is ~~filtrated~~ filtered by No.\_3 filtering apparatus (9). In this process, impurities which ~~is~~ are decomposed and extracted at the second treatment ~~is~~ are removed. ~~Filter~~ The filter which is used in this process is 50% of a fine powder of activated carbon and 50% of calcined zeolite. Further, clay or others can be used.

(10) No.\_3 tank

Tank No.\_3 (10) is a tank ~~to store~~ for storing the liquid part of ~~excrement~~ excrement which passed through No.\_3 filtering apparatus (9). Since the treated water stored in this tank is water which satisfies the environmental standard value, it is possible to discharge the water ~~to~~ into a river. In the present invention, this treated water is reused as washing water for a pigshed.

In the drawings, (11) indicates an ozone generating device and (12) indicates an oxygen generating device. Ozone which is generated in the ozone generating device is supplied to the first ~~treating apparatus~~ and second treating ~~apparatus~~apparatuses. Further, (13) is a specific ray device and by ~~ray~~rays generated in this device, raw ~~excrements~~excrement in the first ~~treating device~~ and second treating ~~device~~devices are irradiated.

~~Results~~The results after being treated by the above--mentioned treatments are shown in Table 2.

Table 2

Items	Water Pollution Control Law	before treatment	after treatment
hydrogen ion conc. pH	5.8-8.6 pH	5.1 (18°C) pH	5.1 (18°C) pH
amount of suspended solid mg/L	200 mg/L	150 mg/L	4.9 mg/L
biological oxygen demand mg/L	160 mg/L	8000 mg/L	30 mg/L
chemical oxygen demand mg/L	160 mg/L	2700 mg/L	20 mg/L
nitrogen content mg/L	120 mg/L	2200 mg/L	60 mg/L
phosphorous content mg/L	16 mg/L	240 mg/L	10 mg/L
escherichia coli Mg/L	3000/L	not measured	not detected

~~Secondary~~Secondarily, one example of an ozone treating apparatus ~~to be used in the present invention is illustrated according to Fig. 3. As shown in Fig. 3, a stirrer 35 is equipped at the center of the inside of tank 31, the object to be treated is introduced from a lower position of the tank through a pipe 33, for example, from a ray treatment apparatus and lead to the top of the tank.~~

Ozone, which is lead through pipe 32 from the ozone generating device, is introduced to a lower position of the tank and contacts with said object to be treated ~~by countercurrent~~ countercurrently and ~~is treated to treat it.~~ And the The treated object is introduced to the next second treatment apparatus through pipe 34.

Fig. 4 shows another example of an ozone treating apparatus used in the present invention. (a) is a front view and (b) is a side view. From an inlet 41 equipped ~~teat~~ at one end of a cylindrical lateral style tank, the object to be treated is introduced and flows in the tank drawing spiral locus toward another end. In the center of another end there is an ozone inlet 42, from where ozone is introduced, contacts with the object to be treated and the treated product 43 is discharged from an outlet 43 located at the center of the tank.

Fig. 5 is an illustration view of a ray--treating chamber, wherein, (a) is an upright style chamber and (b) is a lateral style chamber. As shown in Fig. 5, in the chamber, ray lamps 51 are arranged in parallel and, ~~among each ray lamp~~ among each ray lamp, a guide plate 53 is arranged spirally. ~~Object~~ The object liquid to be treated is introduced from entrance 52, ~~flow~~ flows along ~~with the guide plate 53 and,~~ irradiated by ray lamp 51 and ~~is discharged from outlet 54.~~ Then, it is transported to the next process.

#### APPLICABILITY FOR INDUSTRIAL USE

As mentioned above, since the present invention does not use chemicals at all, a secondary waste product is not formed. Further, the sludge is clarified by physical treatment, that is, ozone

~~treatment~~ and specific ray ~~treatment~~, treatments so that equipment investment and treatment ~~cost~~costs can be reduced.